

***Coryphaeschna huaorania* spec. nov. from central Ecuador with keys to all species in the genus (Odonata: Aeshnidae)**

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Abstract

Coryphaeschna huaorania sp. n. (holotype ♂: Ecuador, Morona Santiago Prov., pond 5 km N of Mendez jct., 6 Nov 1997; allotype ♀, same data; both to be deposited in FSCA, Gainesville, FL, USA) is described and compared with *C. amazonica*, *C. apeora* and *C. perrensi*. The new species can be recognized by having 3 transverse rows of cells in the fork of Rs for a distance of 2 to 4 cells, and a combination of reddish frons without a dark spot, green thorax with small brown mesepisternal stripes, a reddish abdomen, and epiproct about half as long as the cerci. Separate keys are provided to males and females of the eight species currently recognized in the genus.

Introduction

While searching for Odonata in the upper Amazon basin in central Ecuador in 1996, I collected several *Coryphaeschna* larvae, from which I reared one male. In comparing this specimen with all other known species of the genus (Paulson 1994), I found several notable differences but withheld a determination at that time. Upon a subsequent trip with W.F. Mauffray and T.W. Donnelly, we collected two additional males and two females of this species. Examination of these mature specimens indicated that they resembled *C. apeora* Paulson in thoracic pattern but in other aspects appeared similar to *C. amazonica* De Marmels and *C. perrensi* (MacLachlan). However, several differences lead me to believe they represent an undescribed species. The new species is described and compared with the other "red species" of the genus. I also provide separate keys to males and females of the eight species currently considered valid, based partly on color pattern and morphological characters that Paulson (1994) placed in tabular form.

Coryphaeschna huaorania spec. nov.

Figs 1-5, 10

Material

Holotype ♂: Ecuador, Morona Santiago Prov., pond along road 5 km N of Mendez jct. (02°43.7'S, 78°16.2'W), 600 m elevation, 6 Nov 1997, T.W. Donnelly leg.

Allotype ♀: same data as holotype.

Paratypes (2♂, 1♀): Ecuador, Napo Prov., shallow pool near Rio Sabaletto, Parque Nacional Yasuni, larva coll. 17 Jul 1996, K.J. Tennessen, 1♂ emerged 24 Aug 1996; Napo Prov., pond along Loreto Road, 11.8 km W of Rio Payamino ferry (00°28.8'S, 77°04.8'W), 300 m elevation, 18 Nov 1997, K.J. Tennessen, 1♀; same data, W.F. Mauffray, 1♂. The acetoned holotype ♂ and allotype ♀ are presently housed in the T.W. Donnelly Collection, but are to be deposited in the Florida State Collection of Arthropods (FSCA). The paratype ♂ collected by W. Mauffray is deposited in the FSCA; the reared paratype male and the paratype female are in the K.J. Tennessen Collection.

Etymology

Named for the Huaorani people, native to the region of the upper Amazon basin where the specimens were collected.

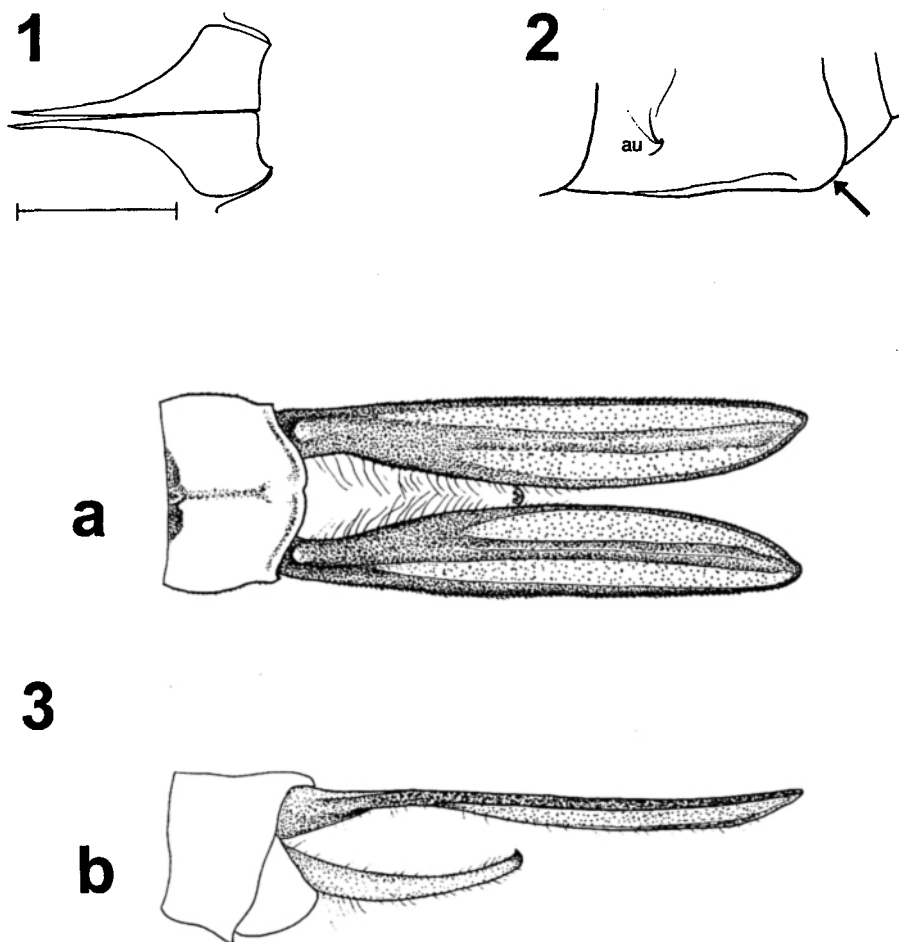
Male (holotype)

Labrum and clypeus dark tan with slight orangish tinge. Base of mandible tan. Anterior surface of frons reddish tan, dorsal surface darker tan, carina of frons well developed and markedly redder than rest of frons. Vertex dark brown basally, ridge tan. Occiput tan. Rear of head black dorsally, greenish tan below.

Pterothorax green with brown stripe along middorsal carina widened anteriorly, isolated brown stripe on mesepisternum 1.7 mm long, and indefinite stripes on meso- and meta-pleural sutures. Trochanters reddish brown, femora reddish brown except apical 1/3 black, tibiae and tarsi black. Wings mostly hyaline, although heavily suffused with orange from base to nodus in anterior half; veins reddish tan proximal to nodus, becoming dark distal to nodus. Triangles 5-celled. Anal loop 11- or 12-celled. Fore wing (FW) with 3 rows of cells between forks of Rs just beyond level of pterostigma for a distance of several cells (3 in left wing, 4 in right). Pterostigmata dark brown dorsally, tan ventrally, surmounting 3.5 cells in left FW, 4 cells in right FW, 2.8 cells in left hind wing (HW), 3.5 cells in right HW. Antenodal crossveins: 24 or 25 in FW, 16 in HW; postnodals: 13 or 14 in FW, 15 in HW.

Abdominal segments (S) 1 and 2 largely green except S2 with a dorsal reddish brown crescent at midlength; S3 mostly reddish brown except green anteroventrally, middorsal carina greenish yellow, and a small narrow vertical green stripe along apical margin of supplementary transverse carina; S4-10 mostly reddish brown except S4-8 with middorsal carina greenish yellow and S4-5 with green stripe distal to supplementary transverse carinae similar to that on S3; S10 reddish brown with elongated black lateral mark; intersegmental annuli largely black; sterna of S4-8 black basally and dark along

median area. Auricles green, outer edges brownish with 2 or 3 black teeth visible in posterior view. Hamular process of anterior hamules 0.77 mm long, abruptly widened at posterior end (Fig. 1). Genital lobe rounded, not projecting from contour of S2 (Fig. 2). Terminal segment of penis with flattened dorsal process bearing arched but parallel spiny patches, between which is a full-length pale fold that protrudes dorsad of the spiny patches (Fig. 10a). Cerci widening in basal tenth in dorsal view, widest at midlength, long hairlike setae on inner margin from base to about 2/3 length, outer margin with very short, stouter setae (Fig. 3a), in lateral view narrow and slightly upturned distally (Fig. 3b); epiproct 1.45 mm wide at base, tapering to narrow conical tip, bifid dorsally, each point with a small sharp tooth, tip at 0.47 times length of cercus (Fig. 3b).



Figures 1-3. *Coryphaeschna huaorania* spec. nov., holotype (Ecuador, Morona Santiago Province): (1) hamular processes of anterior hamules, ventral view, anterior tips to left; (2) genital lobe (indicated by arrow) of abdominal segment 2, lateral view; au = auricle; (3) cerci and epiproct in dorsal (a) and lateral (b) views.

Measurements (mm). Total length including cerci 73, abdomen without cerci 48.5, cerci 6.5 (laterally), HW 47.5, pterostigma of FW 4.2, HW 3.7.

Female (allotype)

Labrum brownish tan basally, darker medially to dark brown distally, with greenish spots mediolaterally. Base of mandible blue. Clypeus and anterior surface of frons bluish tan on anterior surface, blue laterally; dorsal surface of frons blue with brown T-spot, dark brown basally. Vertex blackish brown basally, crest bluish tan. Occiput mostly light blue, ridge tan. Rear of head as in holotype.

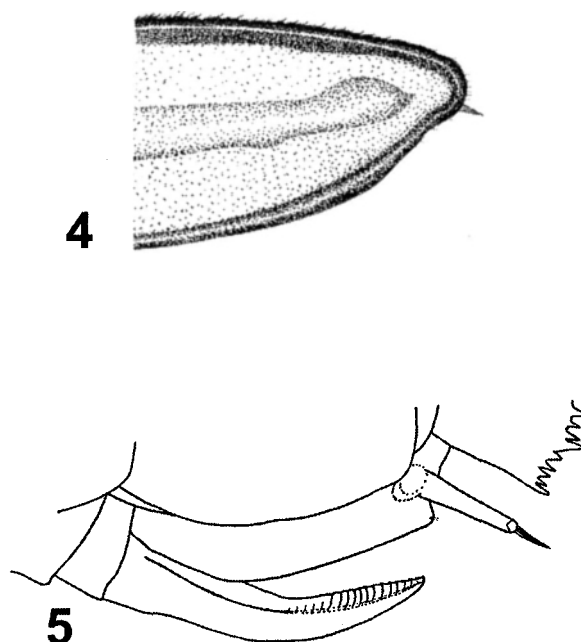
Thoracic color pattern and leg coloration similar to holotype. Wings suffused with amber except nearly hyaline at base; veins reddish brown to nodus, blackish brown beyond. Triangles 5-celled except right FW triangle has an extra small cell basally. Anal loop 13-celled. Fore wings with 2 rows of cells between forks of Rs. Pterostigmata of FW surmounting 4.1 cells, of HW surmounting 3.4 to 3.7 cells. Antenodal crossveins: 24 or 25 in FW, 15 or 16 in HW; postnodals 15 in FW, 17 in HW.

S1 and 2 greenish yellow laterally, dorsum of S2 green in basal half, yellow in distal half, with 2 paired reddish brown marks; S3-10 with color pattern similar to holotype except lateral pale areas larger and reddish brown areas mostly black. Dorsum of S10 concave in profile; dorsal posterior rim of S10 raised medially, with numerous (about 30) low, black spines of varying sizes. Cerci broken off, remaining basal portion <1 mm, total length unknown. Ventral valvula of ovipositor 2.5 mm long, angularly curved upward, ventral margin of lateral valvula straight (Fig. 5); styli of lateral valvula 0.9 mm long, about same length as ventral edge of S10.

Measurements (mm). Total length without missing cerci 73, abdomen without cerci 53, HW 54, pterostigmata: FW 4.75, HW 4.35.

Variation

Males. The length of the brown mesepisternal stripe was 1.3 mm in the male coll. by WFM and 2.4 mm in the reared male. Triangles in FW 5-, 6-, or 7-celled (6th or 7th cell due to split in basal cell), in HW 4- or 5-celled. Antenodals in FW 24-26, in HW 11-14; postnodals in FW 16-17, in HW 13-16. Tip of epiproct at 1/2 length of cerci. There appear to be several significant color changes associated with age which involve an increase in reddish brown color. The male collected by WFM, which is undoubtedly older than the holotype and of course the reared paratype male, has a reddish brown cast over the dorsal and part of the lateral surfaces of the thorax, and has the entire wing area suffused with brownish amber. In addition, S2 is entirely reddish brown dorsally, and the areas distal to the supplementary transverse carinae of S3-5, which are green in the holotype and the reared specimen, are reddish brown. The reared paratype male, which was kept alive and fed small insects for about six days, has the upper surface of the frons with a brown T-spot bordered laterally by green areas, a pattern similar to that of the allotype and paratype females. This male also has a sharp spine on the apex of the cerci (Fig. 4). These apical spines, if present in all males, must get broken off as males mature, as there is no indication of them in either the holotype or the older male collected by WFM. No apical cercal spines were present in two reared males of *C. diapyra* Paulson from Ecuador; I have not examined reared specimens of



Figures 4-5. *Coryphaeschna huaorania* spec. nov.: (4) apical fifth of right cercus of reared paratype male, dorsal view; (5) ovipositor of allotype, lateral view.

the other “red” species. Measurements of paratype males (mm): total length including cerci 72-74, abdomen without cerci 48-49, cerci 6.5 (laterally), HW 47-49, pterostigma of FW 4.2-4.5, HW 3.7-3.8.

Female paratype slightly smaller than allotype. Labrum largely blackish brown, with green mediolateral spots; anterior surface of frons mostly green with tan flecks. Anal loop 9-celled. Ventral valvula of ovipositor 2.45 mm long. Unfortunately the cerci of the paratype ♀ and the allotype are missing; additional specimens with intact cerci will be necessary to determine if diagnostic characters exist in this structure among the red species. Measurements (mm): total length minus cerci 71, abdomen without cerci 52, hind wing length 51, pterostigma of FW 4.6, HW 4.0. The wings of the two *C. huaorania* females are significantly longer than those of the males (HW 51-54 mm vs. 47-49 mm) and have only two rows of cells between the forks of Rs (three rows in males).

The few *C. huaorania* adults taken so far were collected in the afternoon; the only habitats at which they were seen were various small-sized shallow ponds with sparse emergent vegetation. The only other aeshnid seen at these sites was *Coryphaeschna adnexa* (Hagen).

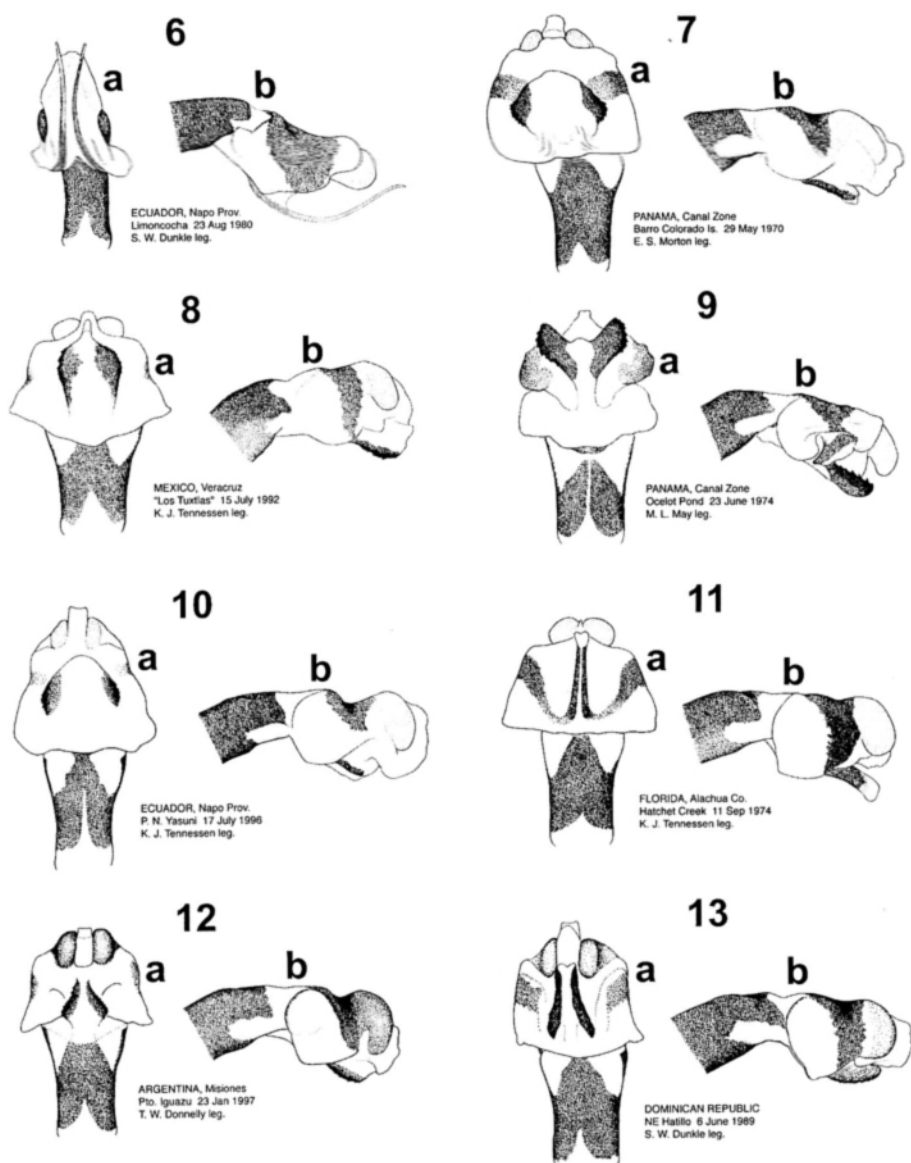
Discussion

Coryphaeschna huaorania resembles *C. apeora* in thoracic and abdominal color pattern, but is smaller (total length 72-74 mm vs 79-85 mm in *apeora*; wing length 47-48.5 vs 51-56 mm in *apeora*). In *C. apeora*, the epiproct is about 2/3 as long as the cerci. Other differences are given in the keys to males and females. Paulson (1994) stated that *C. apeora* is the only *Coryphaeschna* in which the immature T-spot becomes obscured as individuals age; it appears that this occurs also in *C. huaorania*.

Coryphaeschna diapyra is distinct from all the other "red" species by having reddish brown hind tibiae and lacking denticles on the dorsoposterior rim of S10 (some males of *C. perrensi* have dark red on the ental surface of the tibiae). In males of *C. diapyra*, the genital lobe is strongly produced, the hamular process of the anterior hamule is narrow posteriorly, the penis has strong, divergent spiny patches on the dorsum of the terminal segment (Fig. 9; also see Paulson 1994), and the cerci have long setae on the medial edge for about 9/10 their length.

In *C. huaorania* the epiproct extends to half the length of the cerci or less, differing from *C. perrensi* and *C. amazonica* in which it extends beyond the cercal midlength. The apical fourth of the cerci of *C. huaorania* are upturned slightly in lateral view (Fig. 3b), whereas they are straight in *C. amazonica* and *C. perrensi*. Also, males of *C. huaorania* are distinct by having three rows of cells (vs two) between the forks of Rs. The thorax in mature males is very red in *C. perrensi* and *C. amazonica* and lacks brown mesepisternal and meso- and meta-pleural stripes. In the single older male of *C. huaorania* (coll. by WFM) very little red is distinguishable on the dorsum of the thorax, and the brown stripes are clearly evident. The penis of *C. amazonica* and *C. huaorania* has a pale unsclerotized ridge which projects between the relatively weakly developed spiny patches. In *C. huaorania* this ridge, or fold, extends the full length of the dorsal process that bears the spiny patches (Fig. 10b), compared to projecting only in the distal 1/4 in *C. amazonica* (Fig. 7b). In *C. perrensi* the spiny patches converge distally, whereas in *C. amazonica* and *C. huaorania* the patches are roughly parallel and are wider apart.

I collected three males of *C. perrensi* in Bolivia, previously unrecorded for that country (Santa Cruz Dept., Velasco Prov., pond 12 km NW of San Ignacio (16°15.79'S, 60°59.68'W), 11 Nov 1999. The date extends slightly the flight season given by Paulson (1994). In life, the thorax was red dorsally and dorsolaterally, but had a greenish cast ventrolaterally. The compound eyes were mostly orangish red, except for a scarlet spot dorsocentrally, and the abdomen was orangish red. The Bolivia locality is the most northerly yet recorded, although this species is the most southerly distributed of the red species of *Coryphaeschna* (Fig. 14). As noted by Paulson (1994), the ranges of *C. amazonica* and *C. perrensi* appear to be allopatric. *C. diapyra* and *C. apeora* range the furthest north of the red species. The distribution records shown in Fig. 14 are based on literature records and specimens I examined.



Figures 6-13. Terminal segment of penes of the eight species of *Coryphaeschna* in dorsal (a) and lateral (b) views: (6) *adnexa*; (7) *amazonica*; (8) *apeora*; (9) *diapyra*; (10) *huaorania* spec. nov.; (11) *ingens*; (12) *perrensi*; (13) *viriditas*.



Figure 14. Distributions of the red species of *Coryphaeschna* (*amazonica*, *apeora*, *diapyra*, *huaorania* spec. nov., *perrensi*).

Keys to *Coryphaeschna*

The following keys are based largely on color and morphological characters noted by Paulson (1994). I have included several previously unreported differences in the reddish species. The keys are constructed mainly for mature specimens.

Immature individuals of *C. amazonica* and *C. perrensi* usually have a green thorax and could be taken the wrong way in couplet 2. The lack of distinct brown thoracic stripes in mature specimens should correctly lead one to couplet 4, although De Marmels (1989) showed brown stripes in his figure of the thorax of the holotype of *C. amazonica*, and Paulson (1994) reported that young males of this species have a pair of small, mesepisternal brown stripes. Paulson studied fairly large series of both species and found overlap in most of the differences listed by De Marmels, although he confirmed that the pterostigmata are slightly shorter in *C. amazonica* and the triangles are slightly longer. He further stated that the penes are quite similar, but that differences in the dorsal surface of the terminal segment are diagnostic (compare Figs 7 and 12). I have had difficulty trying to find reliable characters other than the penes to separate these two species and offer the characters in couplet 5 above with caution. Identification is facilitated by the allopatry of these two species.

The key for males is supplemented by illustrations of the terminal segment of the penis in both dorsal and lateral views (Figs 6-13). Although the penes are diagnostic, their characteristics are difficult to ascertain, as dried specimens must be relaxed and the penis extruded and straightened so the dorsal surface of the terminal segment can be seen clearly.

Coryphaeschna guyanensis Machet (1991) has been synonymized with *C. adnexa* (Hagen) by Machet (1994). I have examined the holotype, a somewhat teneral male, and agree with the synonymy, but further study is needed to determine if the wide dark thoracic stripes and the acuminate tip of the penis are merely teneral characteristics or if they also occur in mature specimens from the French Guiana area.

Males

1. Abdominal segments 4-10 mostly red, without distinctly contrasting brown and green markings **2**
- 1'. Abdominal segments 4-10 with contrasting color pattern of black or brown markings and green stripes and marks **6**
2. Thorax mostly green, with distinct brown markings along middorsal carina, on mesepisternum and along meso- and meta-pleural sutures **3**
- 2'. Thorax red dorsally and either red or red tinged with green laterally, without distinct brown markings middorsally or on lateral sutures (caution: immature specimens of *amazonica* have a green thorax). **4**
3. Frons green, upper surface with dark brown mark; costa dark brown; epiproct 0.65-0.70 length of cerci; (penis Fig. 8). ***apeora***
- 3'. Frons reddish, upper surface without dark brown mark; costa reddish tan; epiproct 0.47-0.50 length of cerci; (penis Fig. 10). ***huaorania* sp. n.**
4. Costa uniformly dark brown from base to pterostigma; tibiae and tarsi mostly reddish tan or partly dark red; sides of thorax red; (penis Fig. 9) ***diapyra***
- 4'. Costa pale reddish-tan from base to nodus, may be slightly darker toward

pterostigma; tibiae and tarsi very dark to black, tibiae sometimes partly dark red; sides of thorax with greenish cast. **5**

- 5. Vein R1 pale from nodus to wing apex, similar in color to C and M1; triangle of FW 6.4-6.9 mm long; (penis Fig. 7). ***amazonica***
- 5'. Vein R1 from nodus to wing apex much darker than C and M1; triangle of FW 5.8-6.2 mm long; (penis Fig. 12) ***perrensi***
- 6. Face blue; epiproct less than half as long as cerci; hind wing less than 42 mm long; (penis Fig. 6). ***adnexa***
- 6'. Face green; epiproct at least half as long as cerci; hind wing more than 48 mm long **5**
- 7. Thoracic sutures with wide brown stripes; epiproct about half as long as cerci; (penis Fig. 11). ***ingens***
- 7'. Thoracic sutures with narrow brown stripes at most; epiproct more than half as long as cerci; (penis Fig. 13) ***viriditas***

The following key to females contains several new characters which merit further systematic study.

Females

- 1. Dorsum of abdominal segment 10 concave in lateral view, dorsoposterior margin with black denticles **2**
- 1'. Dorsum of abdominal segment 10 straight in lateral view, dorsoposterior margin without black denticles **7**
- 2. Thorax with wide brown stripes (>2 mm) on meso- and meta-pleural sutures; dorsal carinae of abdominal segments 3-7 with >30 conspicuous black denticles ***ingens***
- 2'. Thorax without brown stripes or with indefinite narrow stripes on meso- and meta-pleural sutures; dorsal carinae of abdominal segments 3-7 with few (<20) or no small black denticles **3**
- 3. Distal third of labrum dark brown to black, markedly darker than proximal 2/3; abdomen with dark brown to black marks sharply contrasting with green areas ***viriditas***
- 3'. Distal margin of labrum reddish brown to tan, not markedly darker than proximal part of labrum; abdomen mostly red or with reddish brown marks, with or without green areas **4**
- 4. Dorsum of abdominal segment 10 strongly concave in lateral view; definite brown mesepisternal stripe present; costa beyond nodus usually dark brown **5**

4. Dorsum of abdominal segment 10 weakly concave in lateral view; indefinite brown mesepisternal stripe present or entirely absent; costa beyond nodus reddish **6**
5. Abdomen length 58-63 mm, middle segments nearly uniformly reddish brown; pterostigma of fore wing 5.1-6.0 mm long. ***apeora***
- 5'. Abdomen length 51-53 mm, middle segments with dark brown markings; pterostigma of fore wing 4.3-4.7 mm long. ***huaorania***
6. Pterostigma of fore wing usually less than 4.9 mm long; triangle of fore wing usually 7.0 mm long or more ***amazonica***
- 6'. Pterostigma of fore wing usually more than 4.9 mm long; triangle of fore wing usually less than 7.0 mm long ***perrensi***
7. Labrum green, clypeus blue; hind tibiae completely black ***adnexa***
- 7'. Labrum and clypeus tan to reddish brown; hind tibiae partly dark red at midlength ***diapyra***

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